May 10, 1966 B. A. MONK 3,250,094

METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES

Filed Aug. 27, 1964 9 Sheets-Sheet 1

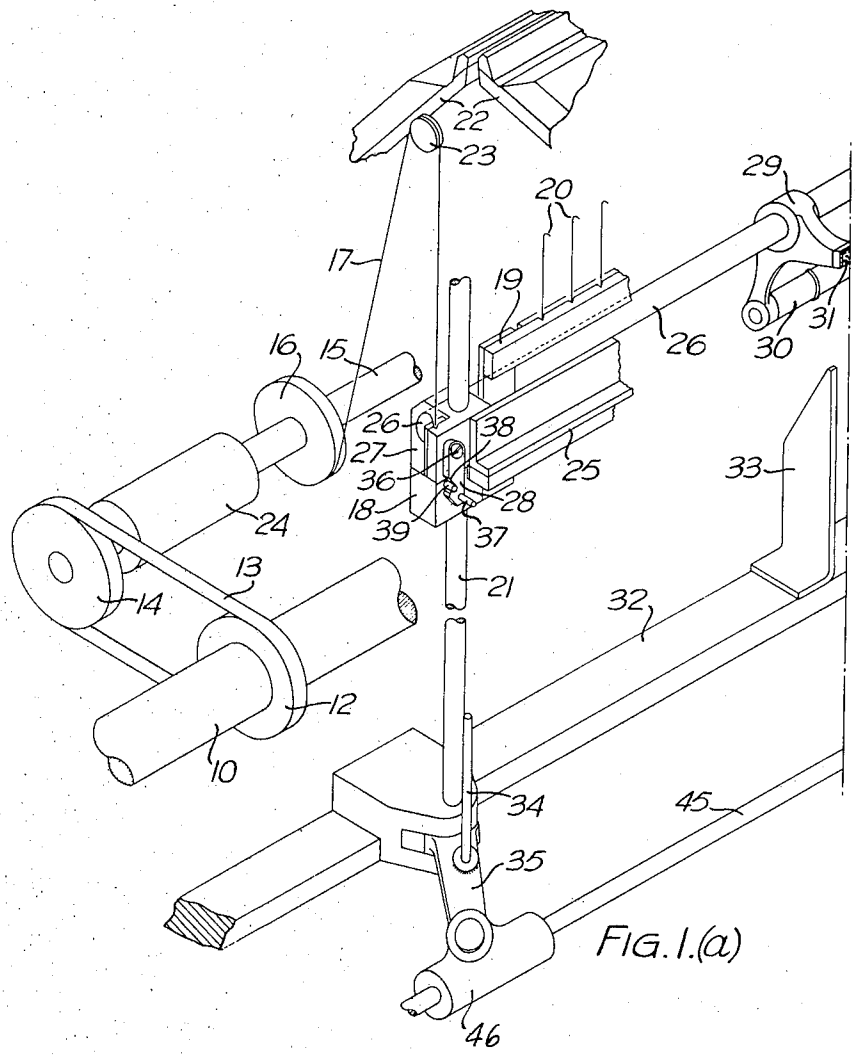


FIG. 1.(a)

Inventor:
Brian Arthur Monk
BY Baldwin & Wight
Attorneys

May 10, 1966 B. A. MONK 3,250,094

METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES

Filed Aug. 27, 1964 9 Sheets-Sheet 2

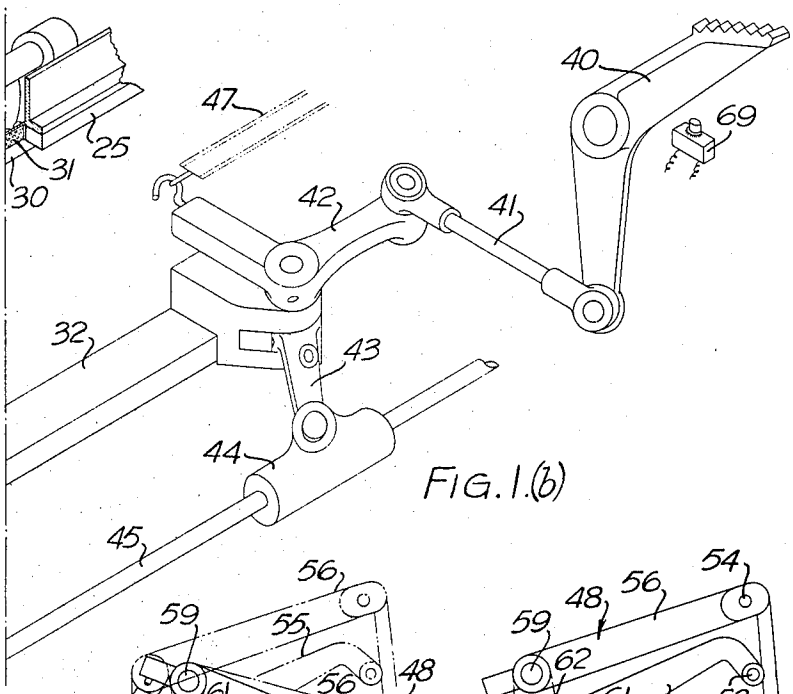


FIG. 1.(b)

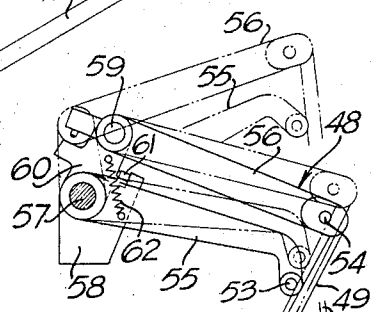


FIG. 2.(a)

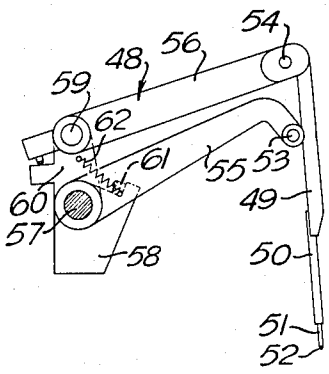
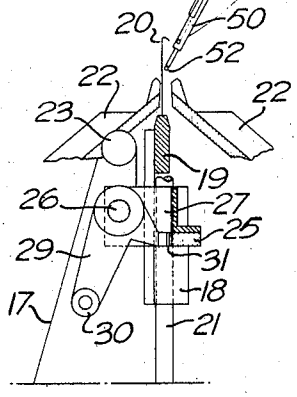
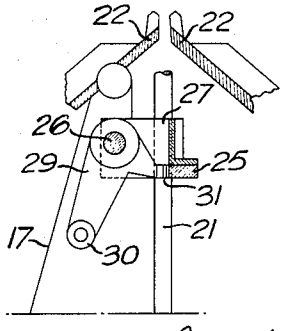


FIG. 4.(a)





Inventor:
Brian Arthur Monk
BY Baldwin & Wright
Attorneys

May 10, 1966 B. A. MONK 3,250,094

METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES

Filed Aug. 27, 1964 9 Sheets-Sheet 3

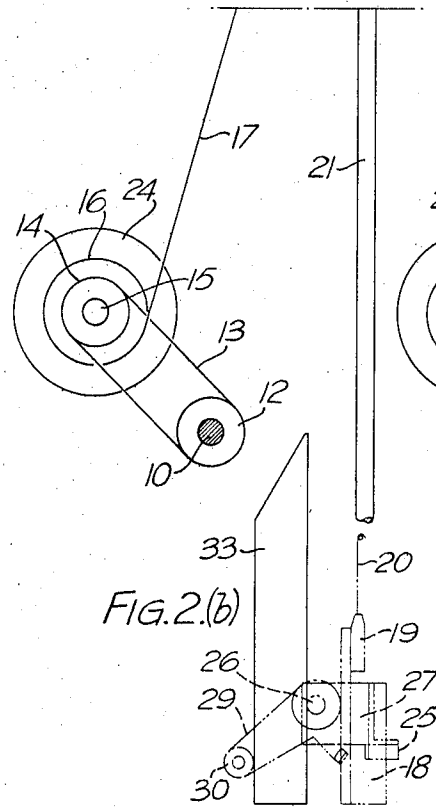


FIG. 2.(b)

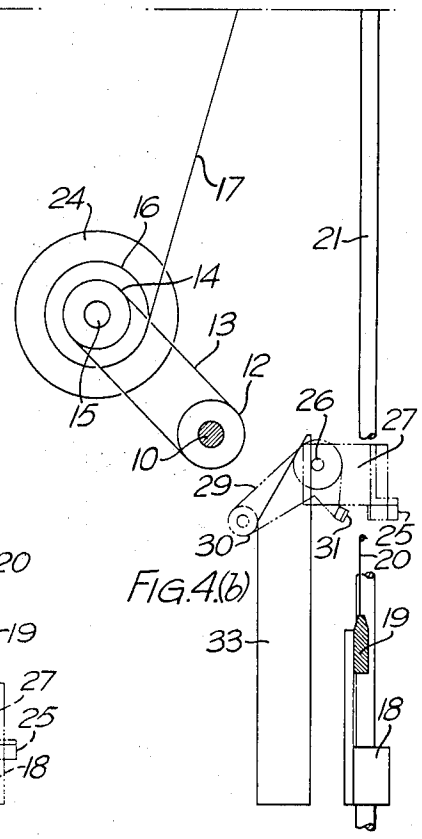


FIG. 4.(b)

FIG. 5.

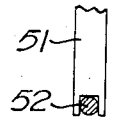


FIG. 6.

Inventor:
Brian Arthur Monk
BY Baldwin & Wight
Attorneys

May 10, 1966 B. A. MONK 3,250,094

METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES

Filed Aug. 27, 1964 9 Sheets-Sheet 4

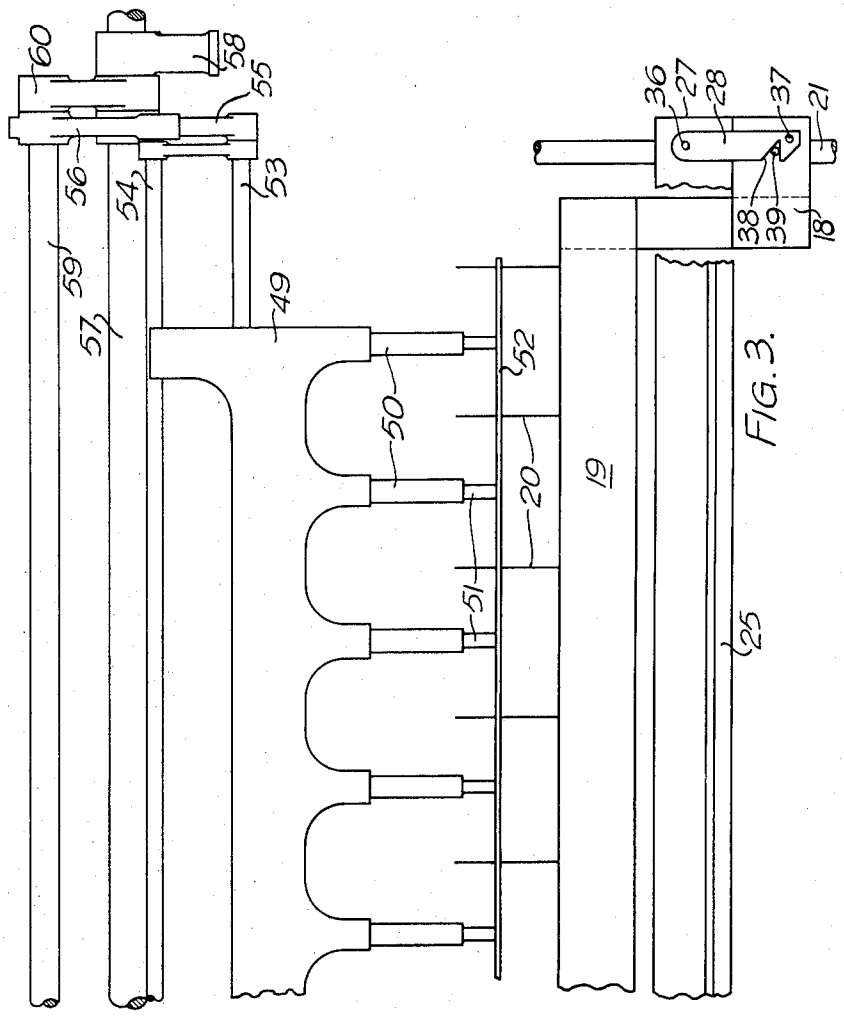


FIG. 3.

Inventor:
Brian Arthur Monk
BY Baldwin & Wright
Attorneys

May 10, 1966 B. A. MONK 3,250,094

METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES

Filed Aug. 27, 1964 9 Sheets-Sheet 5

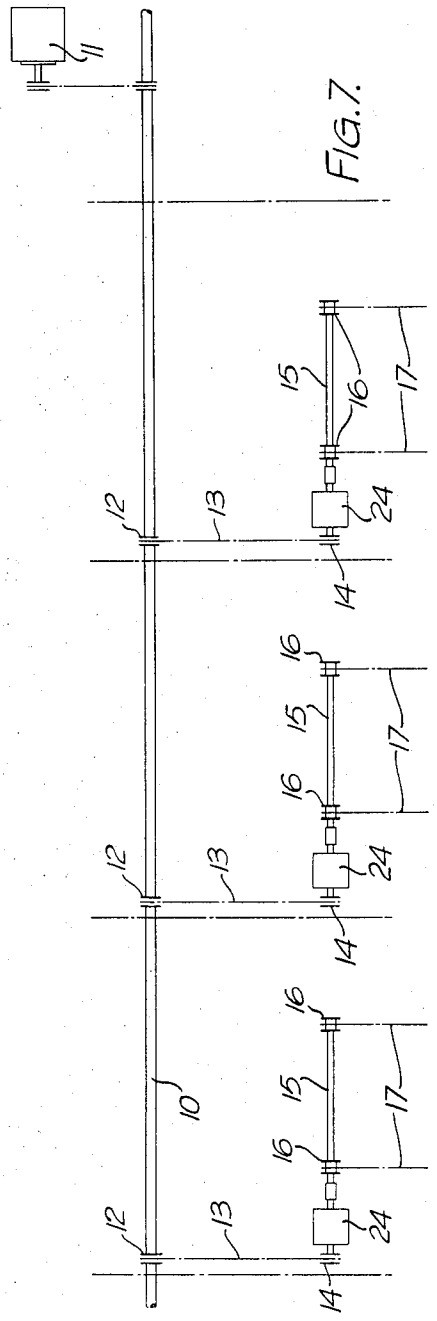


FIG. 7.

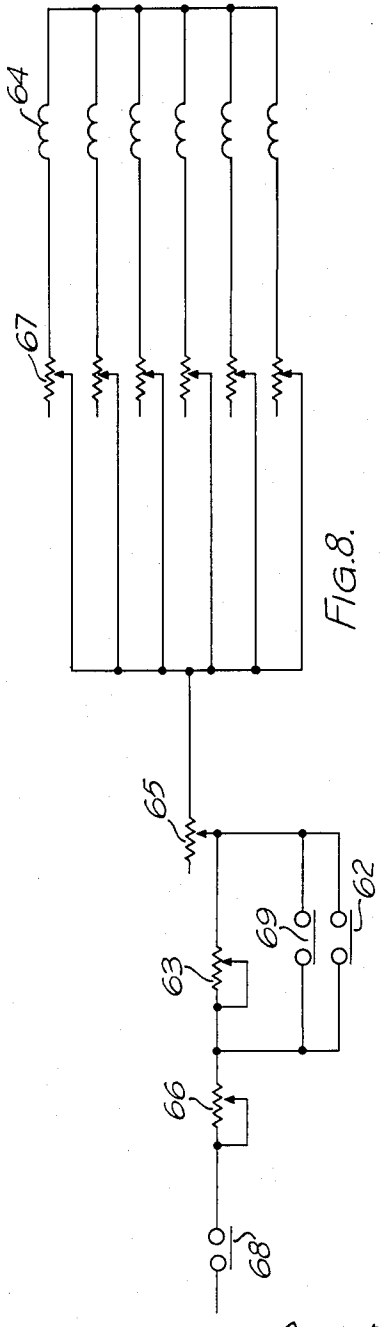


FIG. 8.

Inventor:
Brian Arthur Monk
BY Baldwin & Wight
Attorneys

May 10, 1966 B. A. MONK 3,250,094

METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES

Filed Aug. 27, 1964 9 Sheets-Sheet 6

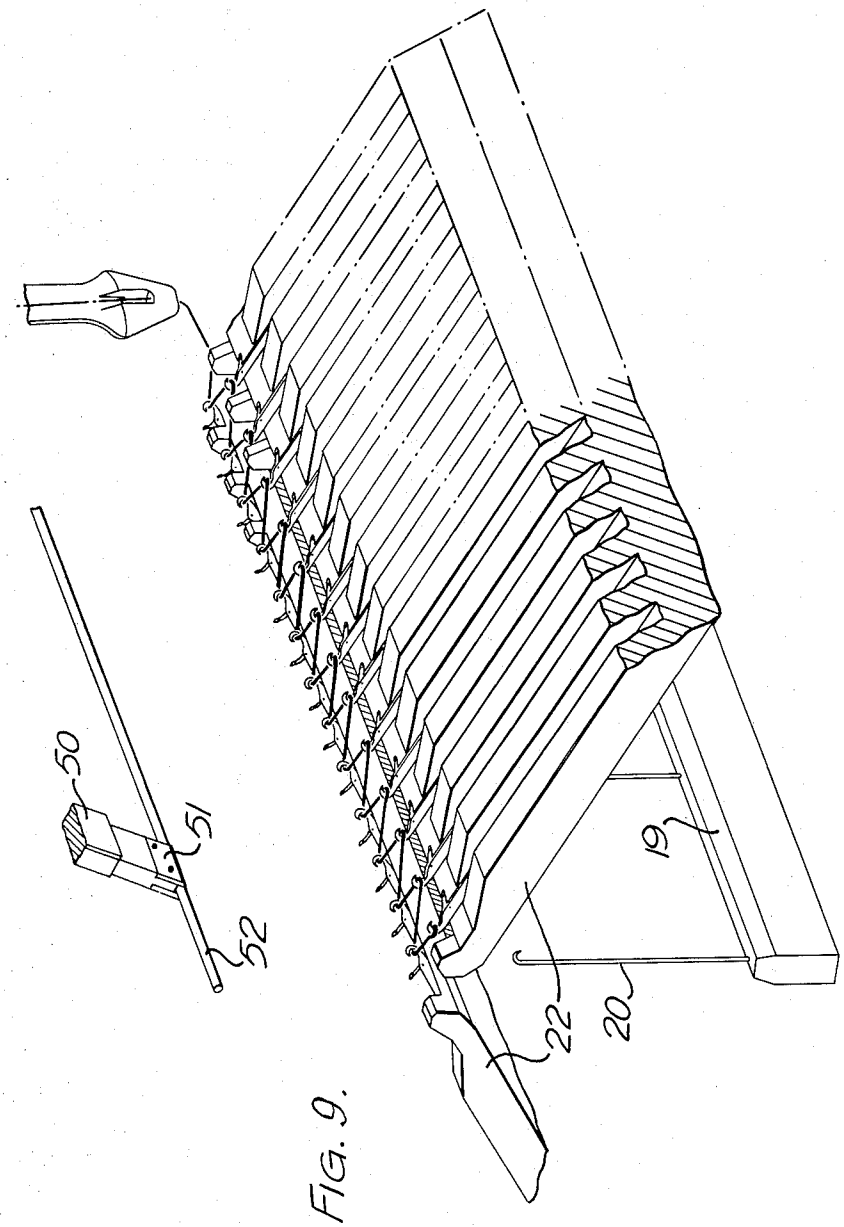


FIG. 9.

Inventor:
Brian Arthur Monk
BY Baldwin & Wight
Attorneys

May 10, 1966 B. A. MONK 3,250,094
METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES
PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES
Filed Aug. 27, 1964 9 Sheets-Sheet 7

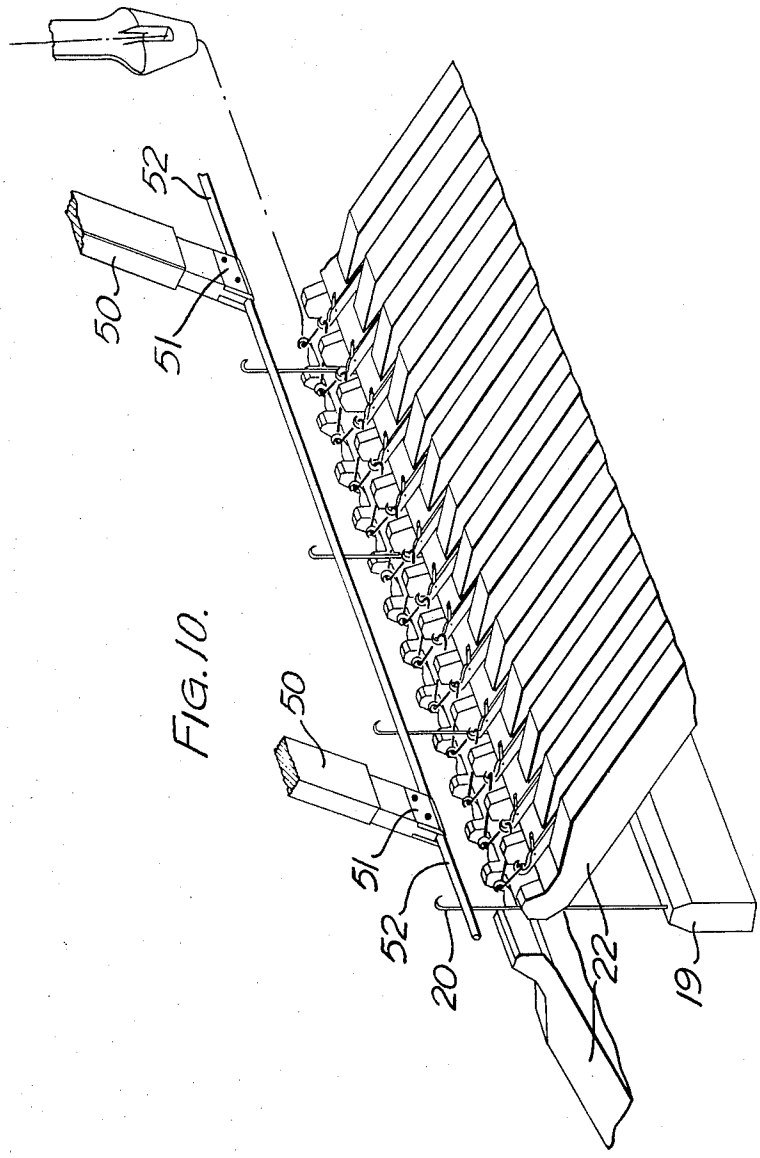


FIG. 10.

Inventor:
Brian Arthur Monk
BY Baldwin & Wight
Attorneys

May 10, 1966 B. A. MONK 3,250,094

METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES

Filed Aug. 27, 1964 9 Sheets-Sheet 8

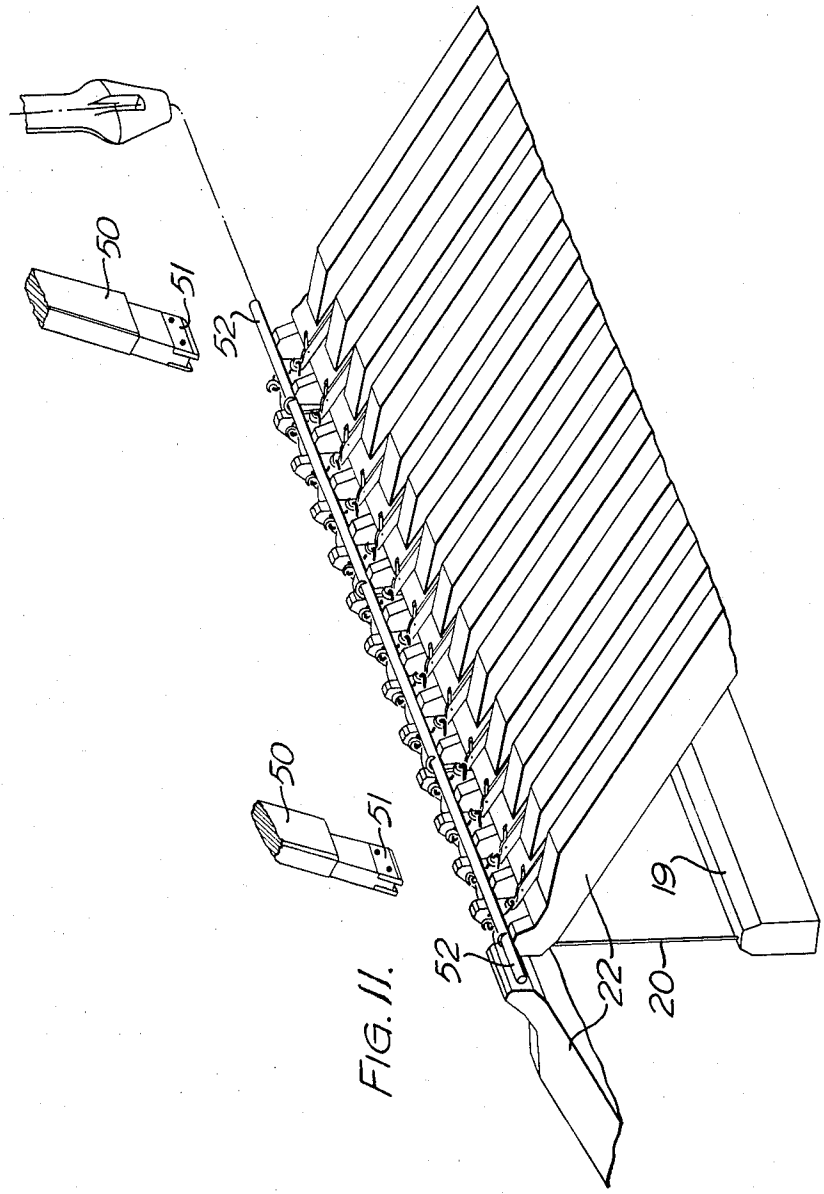


FIG. 11.

Inventor:
Brian Arthur Monk
By Baldwin & Wight
Attorneys

May 10, 1966 B. A. MONK 3,250,094
METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES
PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES
Filed Aug. 27, 1964 9 Sheets-Sheet 9

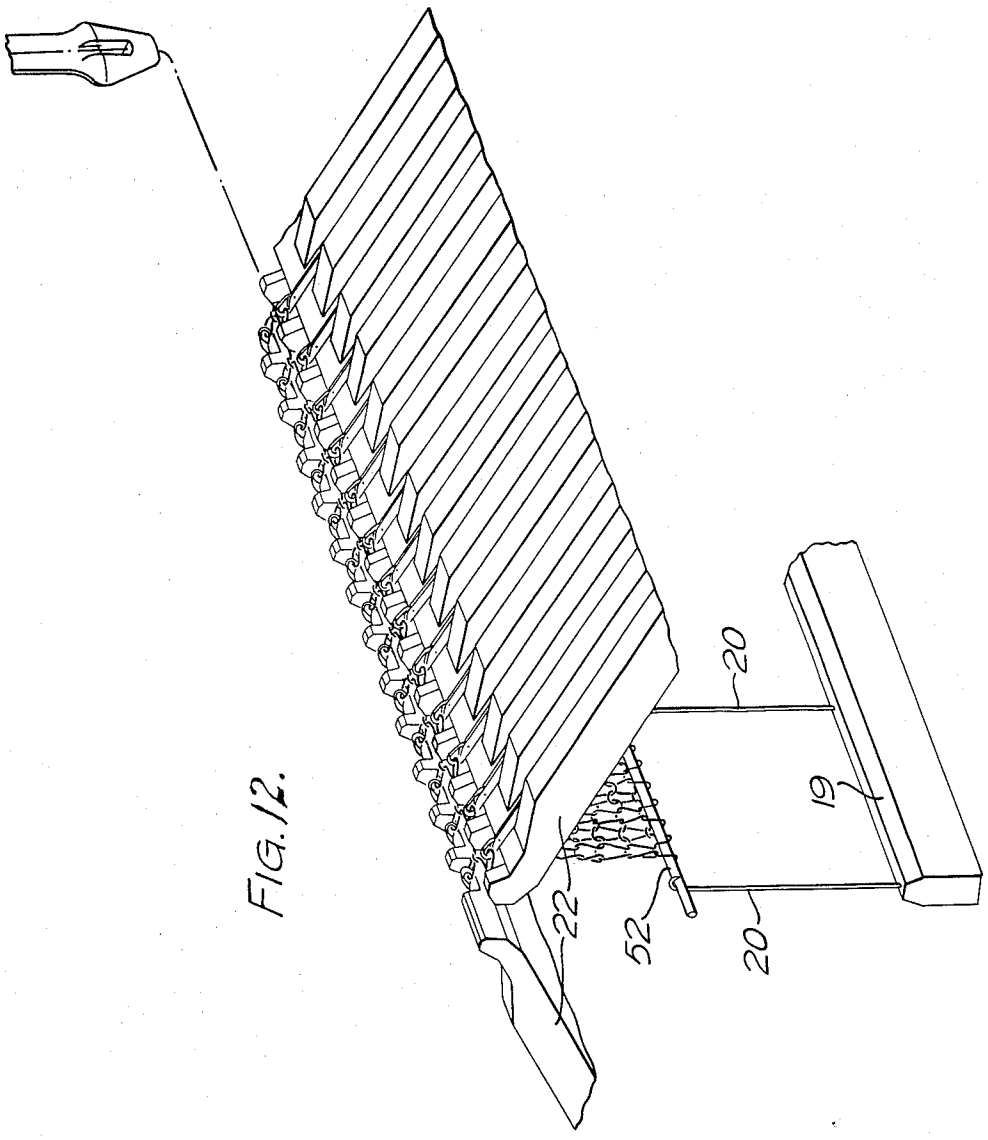


FIG. 12.

Inventor:
Brian Arthur Monk
BY Baldwin & Wight
Attorneys

United States Patent Office 3,250,094 Patented May 10, 1966

3,250,094

METHOD AND APPARATUS FOR APPLYING TENSION TO WORKPIECES PRODUCED ON FLAT BED FULLY-FASHIONED KNITTING MACHINES

Brian Arthur Monk, Linby, England, assignor of one-half to S. A. Monk (Sutton-in-Ashfield) Limited, Sutton-in-Ashfield, England, a company of Great Britain

Filed Aug. 27, 1964, Ser. No. 392,506
Claims priority, application Great Britain, Sept. 6, 1963, 35,318/63
15 Claims. (Cl. 66—149)

This invention relates to a method and apparatus for applying tension to workpieces produced on flat bed fully-fashioned knitting machines, and is more particularly applicable to a method and apparatus for use with multi-head knitting machines, although it is not limited in this respect.

Most fully-fashioned garment pieces, e.g. back, front or sleeves, commence at a much greater width than the finishing width, and in practice it is essential that initial tension should be applied to the full width thereof and that such tension should be applied to the first course which is knitted. If, as is usual, the garment pieces are knitted in "string" form with separating threads between each garment piece, this condition cannot apply since tension can only be applied to the first course of the new garment piece which is the equivalent of the finishing width of the previously knitted garment piece.

The above mentioned disadvantage can be overcome by progressively widening between the end of one garment piece and the beginning of the next garment piece. However, this would entail considerable waste of machine running time and costly yarn and would defeat the whole object of knitting shaped garments which is to save wastage of expensive yarns.

Due to these inherent disadvantages of knitting garment pieces in "string" form, the present invention sets out to provide an improved method and apparatus for tensioning garment pieces which are knitted separately and not in "string" form.

According to the present invention, a method of applying tension to a knitted garment piece produced on a flat bed fully-fashioned knitting machine comprises causing the first course of yard to be drawn by the needles, moving a tension applying device having a series of hooks upwardly towards the yarn on the needles so that the hooks thereof pass beyond the position of the yarn, inserting automatically a length of wire between the hooks of the tension applying device and the first course of yarn, moving the tension applying device downwardly so that the hooks thereof gather the wire and thus also the first course of yarn, and subsequently allowing the weight of the tension applying device to apply tension to the first course and to subsequent courses of the garment piece.

According to a further feature of the invention, the method includes the step of releasing the tension applied through the hooks of the tension applying device when the garment piece reaches a predetermined length, and subsequently applying tension to the garment piece, at a position which is intermediate of its ends, through friction gripping means which also form part of the tension applying device.

According to a still further feature of the invention, the method includes the step of automatically decreasing the tension applied by the tension applying means as the width of the garment piece decreases.

According to the invention furthermore, apparatus for applying tension to a knitted garment piece produced on a flat bed fully-fashioned knitting machine using a length of wire which is held in the first course of yarn, comprises a wire feed mechanism for temporarily holding the length of wire and for moving said wire into a position adjacent the operative ends of the needles of the machine, and tension-applying means for gathering up the wire and thus also the first course of yarn to apply tension to the first and subsequent courses of the garment piece.

In a preferred construction, the wire feed mechanism comprises a pivotally mounted frame having a plurality of spaced permanent magnets against which the wire is held, and the tension-applying means consist of a hooked bar which is moved upwardly to engage the wire and applies deadweight tension, at least during part of the knitting operation, to the first and subsequent courses of the garment piece.

The invention is illustrated by way of example in the accompanying drawings in which,

FIGURES 1(*a*) and 1(*b*) together form a perspective view of part of the apparatus according to the invention with the pivotally mounted wire positioning frame removed,

FIGURES 2(*a*) and 2(*b*) together are a cross-section in part showing the apparatus according to the invention and including the pivotally mounted wire positioning frame shown in an operative position,

FIGURE 3 is an elevation in part corresponding to FIGURE 2(*a*),

FIGURES 4(*a*) and 4(*b*) together are a cross-section corresponding to FIGURES 2(*a*) and 2(*b*) but showing the pivotally mounted wire positioning frame in an inoperative position,

FIGURES 5 and 6 are details of two forms of magnet for holding the garment piece gripping wires,

FIGURE 7 is a schematic view showing the common guide means as applied to a machine at least three knitting divisions,

FIGURE 8 is an electrical diagram as applied to a machine having six knitting divisions, and

FIGURES 9, 10, 11 and 12 are schematic perspective views showing the manner in which a wire is engaged with the yarn and tension applied to the yarn therewith.

Referring to the drawings, the invention will now be described generally with reference to a single knitting head, it being understood that, when applied to a multi-head machine, the apparatus, with the exception of certain parts which are common to all heads, will be repeated in each knitting division.

As shown in the drawings, there is provided a continually revolving shaft **10** driven by a motor **11** (FIGURE 7), the shaft, in the case of a multi-head machine, extending the full length thereof and being common to all knitting divisions. The shaft **10** is provided, adjacent the, or each, knitting division with a pulley or sprocket wheel **12** which is coupled, via a belt or chain **13**, to a pulley or sprocket **14** fixed to an operating shaft **15** arranged in the, or each, knitting division.

Each operating shaft **15** has two spaced cable drums **16**, one end of the cables **17** of each of which is adapted to be wrapped around the drum and the other ends of which are passed over pulleys **23** and secured to a tension applying device.

The, or each, operating shaft **15** is formed in two parts which are coupled together by a magnetic clutch **24** which is of the type which is able to transmit a variable torque according to the current applied. The input and output shafts of the clutch are connected only by magnetic attraction and are arranged so that, via the main shaft **10**, the input shaft is continually rotating in such manner that the output shaft has a tendency always to wrap the cables **17** on the drums **16** and to bias the tension applying device in an upward direction, against the force of

gravity. Thus, as hereinafter described, the magnetic clutch **24** provides in effect variable counterbalancing means for the tension applying means.

The tension applying means comprise brackets **18** supporting a bar **19** having a series of spaced hooks **20**, said brackets **18** being slidable on vertical guide members **21** arranged at or near each end of co-operating needle beds **22**. The tension applying device also includes an angle bar **25** and a shaft **26** both of which are secured at their ends to blocks **27**, to which the ends of the cables **17** are fixed, which blocks are slidable on the vertical guide members **21**. The blocks **27** are disposed above the brackets **18** and the latter are detachably secured to the blocks **27** by means of latches **28**. Furthermore, the bar **25** and the shaft **26** are secured to the blocks **27** in spaced relationship with one another so as to allow passage of the hooked bar **19**, which is fixed to the brackets **18** in a position above the bar **25** and the shaft **26**, therebetween.

The shaft **26** has pivotally mounted thereon a plurality of bellcrank levers **29**. One arm of the bellcrank levers serves to support a roller or rollers **30** which also act as a counterweight or counterweights, and the other arms are provided with, or support, a pad or pads of friction material **31**, the arrangement of the levers being such that the friction material is biased into engagement with the bar **25** as can be seen in FIGURES 2(*a*) and 4(*a*).

Arranged on a support bar **32** is a cam plate **33** which is positioned in such manner that it is engaged by the rollers **30** during the vertical downward movement of the tension applying device thereby pivoting the bellcrank levers **29** so that the pads **31** are moved away from the bar **25** as can be seen in FIGURES 2(*b*) and 4(*b*). The purpose of this is to avoid interference with the hooked bar **19** when, as hereinafter described, the brackets **18** are disconnected from the blocks **27**.

The means for effecting disconnection between the brackets **18** and the blocks **27** comprises upstanding pins **34** which are fixed to lever **35**, pivotally mounted on the axes of the guide members **21**, in such manner that movement of the levers **35** causes the pins **34** to move in an arcuate path.

Movement of the pins **34** is effective, when the tension applying device is in the appropriate position, to disengage the latches **28**, which are mounted at one end on a hinge pin **36** fixed to the block **27**, from the brackets **28**. This is carried out by the pins **34** engaging projections **37** on the brackets **28** in such manner as to move the latter about their hinge pins **36** and to move the hook-shaped portion **38** out of engagement with projections **39** on the brackets **28**.

Movement of the levers **35** is effected by foot pedal **40** which is connected, via a link **41**, a bellcrank lever **42**, a further link **43** and a coupling **44** to an actuating rod **45** attached, through a coupling **46**, to the levers **35**. In the case of a multi-head machine, the actuating rod **45** extends the full length of the machine and is coupled to the levers **35** of each knitting division so that the pedal **40** is effective to actuate the levers **35** of all the knitting divisions simultaneously. As shown in FIGURE 1(*b*), the foot pedal **40** is biased into an inoperative position by a tension spring **47** connected to the bellcrank lever **42**.

A wire feed mechanism **48** (FIGURES 2(*a*) and 4(*a*), which comprises a pivotally mounted frame **49**, is arranged above the needle beds **22** of the machine, the frame including a plurality of spaced arms **50** provided at their ends with permanent magnets **51** having grooved ends, for example as shown in FIGURES 5 and 6 of V-shaped cross-section, to receive and to hold a length of wire **52**.

The frame **49** is mounted on pivot rods **53** and **54** which are supported on parallel links **55** and **56**. The link **55** is connected at one end to the pivot rod **53** and at its other end to a shaft **57** mounted in end brackets **58**. The link **56** is connected at one end to the pivot rod **54** and at its other end to a shaft **59** which is supported by cross links **60** pivotally mounted on the shaft **57**. The links are so arranged and constructed that, during movement from an inoperative position where the wire **52** is manually attached to the magnets **51**, to an operative position where the wire is removed from the magnets, the wire supporting ends of the magnets are caused to follow an arcuate path until they reach a point slightly above the operative ends of the needles of the machine as is shown in FIGURES 2(*a*) and 10, and thereafter to move in a straight line to a position where the wire is held in a position immediately adjacent the operative ends of the needles. This is due to the fact that, during initial movement of the mechanism, the whole mechanism turns about the shaft **57** until the cross-link **60** engages a stop **61** on the bracket **58**, and thereafter the two links **55** and **56** can only pivot about the shafts **57** and **59** respectively. A tension spring **62** ensures that the links are initially moved together with one another.

The purpose of constraining the end of the frame, and thus also the wire attached thereto, to follow the path described is to avoid the possibility of the frame fouling other parts (not shown) of the machine such as the fashioning elements, the brushes and the yarn carriers, which are associated with the needle beds.

In operation, the first course of yarn is drawn by the needles, as is shown in FIGURE 9, and thereafter the tension applying device is moved upwardly from below the needle beds **22** so that the hooks **20** of the bar **19**, which are arranged in spaced relationship with one another, pass beyond the course of yarn to the position shown in FIGURE 10. This is effected by closing a switch **62** (FIGURE 8) which short circuits a resistance **63** allowing sufficient current to pass to the coil **64** of the clutch **24** to overcome the weight of the tension applying device to cause the latter to be moved upwardly. (The remaining coils shown in FIGURE 8 are for use in a multi-head machine where all the clutches operate simultaneously. The wire **52** is then moved, as hereinbefore described, into a position where it lies between the first course of yarn, as shown in FIGURE 10, and the hooks **20** of the hooked bar **19**, and the tension applying device, which provides a dead weight, is moved downwardly by adjusting the clutch **24** so that the hooks **20** gather the wire, pulling it away from the influence of the magnets **51** and drawing it into contact with the first course of loops which are tensioned thereby as is shown in FIGURE 11. It will be appreciated that, when the yarn for the second course is drawn by the needles, the loops will be formed over the wire **52** so that the latter is held in position in the loops as can be seen in FIGURE 12. As subsequent courses are knitted the dead weight of the tension applying device applies continued tension to the garment piece as can be understood from FIGURE 12.

As previously mentioned, the starting width of a garment piece is usually wider than the finishing width and, on fully-fashioned machines, it is usual to use fashioning fingers to transfer loops on the selvedges inwards or outwards to shape the garment piece. Thus, the tension which is applied to the fabric being knitted is transferred in part to the fashioning fingers. As the fabric gets narrower, the proportion of the tension applied to the fashioning fingers increases and, if this becomes too great, the fashioning fingers will distort and result in unreliable fashioning.

Thus, as indicated, the tension applied to the garment piece is reduced as the knitting width of the garment piece reduces. This is effected by means of a variable resistance **65** arranged in the circuit of the clutch coil **64**. Variation of the torque applied by the clutch **24** is achieved in any desired manner such as by fitting to the resistor a gear which meshes with a toothed rack, the rack being attached to the means controlling the knitting width of the garment piece. Thus, as the width alters,

the resistance varies to alter the torque applied by the clutch.

A further resistance **66** is provided in the circuit and constitutes a range setting resistance which can be set manually to increase or decrease the effective torque of the clutch **24** to suit different knitting conditions. In the case of a multi-head machine further resistances **67** are provided to trim the individual clutches in order to match their torques to the same figure. Alternatively, the resistances can be used to vary the torques one to the other if it is required to knit different yarns on each knitting head which may require different fabric tension conditions. A switch **68** is provided to isolate the clutch circuit.

When the garment piece reaches a certain length i.e. a length where the downward movement of the tension applying device reaches its maximum, and it is required to extend the length thereof by knitting still further, the foot pedal **40** is depressed to disengage the brackets **18** from the blocks **27**. In this respect, it will be understood that, when the tension applying device nears the end of its stroke, the rollers **30** will engage the cam plate **33** to pivot the bellcrank levers **29** so that the friction pads **31** will move away from the bar **25** as indicated in FIGURES 2(*a*) and 4(*a*).

Pressure on the foot pedal **40** pivots the latches **28** as hereinbefore described and, at the same time, causes actuation of a switch **69** (FIGURES 1(*b*) and 8) which short circuits the resistance **63** to operate the clutch **24** in the manner hereinbefore described with reference to the switch **62**.

Thus, the hooked bar **19** remains stationary and retains the end of the garment piece and the bar **25** with its associated parts is moved upwardly under the action of the clutch. In moving upwardly, the bar **25** and the friction pads **31** pass the hooked bar **19** on opposite sides thereof, the friction pads having been pivoted out of position for this purpose by the cam **33**, and after clearing the cam **33**, the bar **25** and the friction pads **31** slide over opposite faces of the garment piece. On reaching the uppermost position, the foot pedal **40** is released and the pads **31** under the action of the roller weights **30** press the material against the bar **25** and grip it. Further, tension is thereafter applied to the material by the weight of the bar **25** and its associated parts.

The tension applied is varied according to the knitting width in the manner hereinbefore described.

It will be understood that, where a machine is intended for knitting only short lengths of material, or where it is practical to provide greater than average space below the machine to accommodate long lengths of material, the bar **25** and its associated parts can be dispensed with and tension applied by the hooked bar only. In this respect, it will be obvious that the cables **17** will be secured to the brackets **18** and not to the blocks **27**.

Thus, it will be seen that the invention provides a simple but efficient method and apparatus for applying the necessary tension to a garment piece being knitted, the particular advantage of the automatic feed mechanism for the wires **52** being that it does not result in loss of time since the operator places the wires in position on the feed means, during a knitting operation, in readiness for the next operation and does not have to stop the machine whilst he places each wire in position at each knitting section.

What I claim is:

1. A method of applying tension to a knitted garment piece on a flat bed fully-fashioned knitting machine comprising the steps of causing the yarn for the first course of knitting to be drawn by the needles, moving a tension applying device having a series of projecting hooks upwardly towards said yarn drawn on said needles so that said hooks pass beyond the position of said drawn yarn, inserting automatically a length of wire between said hooks and said first course yarn, moving said tension applying device downwardly so that said hooks gather said wire and said first course yarn, and subsequently allowing the weight of said tension applying device to apply tension to said first course and to subsequent courses of the garment piece.

2. A method of applying tension to a knitted garment piece on a flat bed fully-fashioned knitting machine comprising the steps of causing the yarn for the first course of knitting to be drawn by the needles, moving a tension applying device having a series of projecting hooks upwardly towards said yarn drawn on said needles so that said hooks pass beyond the position of said drawn yarn, inserting automatically a length of wire between said hooks and said first course yarn, moving said tension applying device downwardly so that said hooks gather said wire and said first course yarn, allowing the weight of said tension applying device to apply tension to said first course and to subsequent courses, releasing the tension applied through said hooks of said tension applying device when the garment piece reaches a predetermined length, and subsequently applying tension to said garment piece, at a position which is intermediate of its ends, through friction gripping means which also form part of said tension applying device.

3. A method as claimed in claim **2**, which includes the step of decreasing automatically the tension applied by said tension applying device as the knitting width of said garment pieces decreases.

4. Appaartus for applying tension to a knitted garment piece on a flat bed fully-fashioned knitting machine using a length of wire which is held in the first course of knitting, which comprises a wire feed mechanism for temporarily holding said length of wire and for automatically moving said wire into a position adjacent the operative ends of the needles of the machine, and tension applying means which gather up said wire, and thus also said first course of yarn, and apply tension to said first course and to subsequent courses of knitting.

5. Apparatus for applying tension to a knitted garment piece on a flat bed fully-fashioned knitting machine using a length of wire which is held in the first course of knitting, which comprises a wire feed mechanism for temporarily holding said length of wire and for automatically moving said wire into a position adjacent the operative ends of the needles of the machine, and tension applying means which gather up said wire, and thus also said first course of yarn, and apply tension to said first course and to subsequent courses of knitting, said wire feed mechanism consisting of a series of spaced magnets to which said wire is attached, and a frame structure mounting said magnets, said frame structure being capable of moving between an inoperative position and an operative position where said magnets, and thus also said wire, are disposed adjacent said operative ends of said needles.

6. Apparatus as claimed in claim **5**, in which said frame structure is supported on parallel links which are so arranged and constructed that the trajectory of said magnet ends, when moving from said inoperative position to said operative position, is first arcuate and then follows a straight line.

7. Apparatus as claimed in claim **6**, in which the ends of said links are pivotally connected to four different shafts one of which shafts is in a fixed position, and a cross link is provided between said fixed shaft and the shaft supporting the adjacent end of the other of said parallel links, wherein in use initial movement of said wire feed mechanism is such that the whole of said frame structure and said links are pivoted about said fixed shaft and subsequent movement is such that said links pivot about their own respective shafts.

8. Apparatus for applying tension to a knitted garment piece on a flat bed fully-fashioned knitting machine using a length of wire which is held in the first course of knitting, which comprises a wire feed mechanism having

a series of magnets to which said wire is temporarily attached and a frame structure mounting said magnets, said frame structure being adapted for movement automatically between an inoperative position where said wire is attached to said magnets and an operative position where said magnet ends, and thus also said wire, are disposed adjacent the operative ends of the knitting needles, and tension applying means which gather up said wire and thus also said first course of knitting and apply tension to said first course and to subsequent courses of knitting, said tension applying means including a hooked bar, vertical guide members on which said hooked bar is slidably mounted, and drive means for moving said hooked bar in a vertical direction.

9. Apparatus for applying tension to a knitted garment piece on a flat bed fully-fashioned knitting machine using a length of wire which is held in the first course of knitting, which comprises a wire feed mechanism having a series of magnets to which said wire is temporarily attached and a frame structure mounting said magnets, said frame structure being adapted for movement automatically between an inoperative position where said wire is attached to said magnets and an operative position where said magnet ends, and thus also said wire, are disposed adjacent the operative ends of the knitting needles, and tension applying means which gather up said wire and thus also said first course of knitting and apply tension to said first course and to subsequent courses of knitting, said tension applying means including a hooked bar, vertical guide members on which said hooked bar is slidably mounted, a second bar slidably mounted on said vertical guide members, friction means operatively attached to said second bar, said second bar being detachably connected to said hooked bar, and drive means for moving said hooked bar and said second bar together in a vertical direction and for moving said second bar alone in a vertical direction.

10. Apparatus for applying tension to a knitted garment piece on a flat bed fully-fashioned knitting machine using a length of wire which is held in the first course of knitting, which comprises a wire feed mechanism having a series of magnets to which said wire is temporarily attached and a frame structure mounting said magnets, said frame structure being adapted for movement automatically between an inoperative position where said wire is attached to said magnets and an operative position where said magnet ends, and thus also said wire, are disposed adjacent the operative ends of the knitting needles, and tension applying means which gather up said wire and thus also said first course of yarn and apply tension to said first course and to subsequent courses of knitting, said tension applying means including a hooked bar, vertical guide members on which said hooked bar is slidably mounted, a second bar slidably mounted on said vertical guide members, friction means in the form of bellcrank levers one arm of each of which supports a friction pad and the other arm of each of which supports a roller, said friction means being operatively attached to said second bar, pivotally mounted latches by which said hooked bar and said second bar are detachably connected together, means for pivoting said latches for disconnecting said hooked bar from said second bar, and drive means for moving said hooked bar and said second bar together in a vertical direction and for moving said second bar alone in a vertical direction.

11. Apparatus for applying tension to a knitted garment piece on a flat bed fully-fashioned knitting machine using a length of wire which is held in the first course of knitting, which comprises a wire feed mechanism having a series of magnets to which said wire is temporarily attached and a frame structure mounting said magnets, said frame structure being adapted for movement automatically between an inoperative position where said wire is attached to said magnets and an operative position, where said magnet ends, and thus also said wire, are disposed adjacent the operative ends of the knitting needles, and tension applying means which gather up said wire and thus also said first course and apply tension to said first course and to subsequent courses of knitting, said tension applying means including a hooked bar, vertical guide members on which said hooked bar is slidably mounted, a second bar slidably mounted on said vertical guide members, friction means in the form of bellcrank levers one arm of each of which supports a friction pad and the other arm of each of which supports a roller, said friction means being operatively attached to said second bar, pivotally mounted latches by which said hooked bar and said second bar are detachably connected together, means for pivoting said latches for disconnecting said hooked bar from said second bar, and drive means for moving said hooked bar and said second bar together in a vertical direction and for moving said second bar alone in a vertical direction, said drive means comprising a magnetic clutch mechanism.

12. Apparatus as claimed in claim **11**, in which said means for disconnecting said hooked bar from said second bar comprise upstanding pins which are movable to disengage said latches, a foot operated pedal, and a linkage system extending between said foot operated pedal and said upstanding pins.

13. Apparatus as claimed in claim **12**, which includes means for varying the tension applied by the dead weight of said tension applying means, said means comprising a variable resistance in the electric circuit to said clutch mechanism, said resistance being controlled by the knitting width control means of the knitting machine.

14. Apparatus as claimed in claim **13**, including switch means, also operable by said foot operated pedal, to short circuit a second resistance in said clutch circuit to cause movement of said second bar in a vertical direction.

15. Apparatus as claimed in claim **14**, including second switch means operable manually for short circuiting said second resistance to cause movement of said hooked bar, together with said second bar, in a vertical direction.

References Cited by the Examiner

UNITED STATES PATENTS

1,986,746	1/1935	Quick et al.	66—149
2,217,521	10/1940	Miller	66—149 X
2,381,072	8/1945	MacDonald et al.	66—149

DONALD W. PARKER, *Primary Examiner.*

P. C. FAW, *Assistant Examiner.*